

GALAPAGOS REPORT 2013-2014

NEW APPROACHES

MONITORING THE GALAPAGOS ECOSYSTEM: A TOOL FOR DECISION-MAKING

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The **Galapagos National Park Directorate** has its headquarters in Puerto Ayora, Santa Cruz Island, Galapagos and is the Ecuadorian governmental institution responsible for the administration and management of the protected areas of Galapagos.

The **Governing Council of Galapagos** has its headquarters in Puerto Baquerizo Moreno, San Cristóbal Island, and is the Ecuadorian governmental institution responsible for planning and the administration of the province.

The **Charles Darwin Foundation**, an international non-profit organization registered in Belgium, operates the Charles Darwin Research Station in Puerto Ayora, Santa Cruz Island, Galapagos.

Galapagos Conservancy, based in Fairfax, Virginia USA, is the only US non-profit organization focused exclusively on the long-term protection of the Galapagos Archipelago.



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Monitoring the Galapagos ecosystem: A tool for decision-making

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Those with responsibility for the Galapagos Archipelago strive daily to make sound decisions about the fate of the highly complex and ultimately fragile Galapagos ecosystem. They do so without access to insights that could be provided by a set of key, integrated indicators of the “vital signs” of the Galapagos ecosystem. Although targeted monitoring has already played a significant role in advancing specific ecosystem conservation and adaptive management of complex issues in Galapagos, a more holistic approach is needed.

This article provides a synthesis of insights I have derived from two decades of engagement with various ecological monitoring programs around the world. I have had the good fortune to work on ecosystem monitoring programs in Brazil, Russia, Tanzania, the United States, and Galapagos. My intent is not to provide a detailed blueprint for monitoring the Galapagos; this can only be done successfully through an extended and collaborative process. My aim is to provide some novel perspectives on the current state of ecosystem monitoring around the world, which will help advance the discussion on how we might comprehensively monitor the Galapagos ecosystem.

Scientific evidence as the basis for decision-making

An effective program for monitoring the state of the Galapagos ecosystem should be about enabling scientific evidence to be the basis for decision-making. Of course, conservation is mostly about politics. We all know that. But over the last 100 years since the idea of conservation first became established in the western hemisphere, we have learned that ecosystems, species, and ultimately humans are best served over the long-term by decision-making based on the best available science. This has been the model, albeit imperfectly implemented, that has enabled the expansion of environmental conservation as a concern of modern human society. Decision-making based on science is not just good logic but also efficient because science, if done well, can point to useful solutions quickly. Moreover, science can provide an effective “shield” for management authorities trying to meet their long-term mandates in the face of constant political manoeuvres for short-term gain by opponents.

Science versus monitoring

The government of Ecuador has a mandate to protect Galapagos ecosystems and the services they provide. It is perhaps surprising then that there is no integrated scheme in place to monitor the Archipelago despite the recent and exponential rise in scientific studies there. But science is not monitoring. Many researchers travel to Galapagos to pursue their own interests, as the lack of researchers focused on the obvious problems facing Galapagos attests. So much research is

done in Galapagos but what of it is relevant to Galapagos? Each study completed usually succeeds in generating interesting publications in prestigious scientific journals. Much of it includes recommendations for environmental management. But use of these scientists' reports by decision-makers is minimal. Unorganized, academic-driven science takes too long to be delivered. And when it is, its form is often incomprehensible to non-scientists and often simply irrelevant to begin with. Tracking what is happening in the Galapagos ecosystem, and forecasting its future, will require a program dedicated to that purpose.

Biodiversity monitoring as a priority

A comprehensive system for monitoring the Galapagos ecosystem would and should have a heavy emphasis on biodiversity monitoring. Many of the ecosystem services we rely on in Galapagos are in fact expressions of biodiversity. As such, the biodiversity of Galapagos contributes enormously to the national and even global economy. Yet it receives relatively little investment in return. This is not to say that biodiversity monitoring should be the sole focus – many physical, social, and economic aspects of the environment must be measured at the same time. But biodiversity monitoring should feature prominently in any monitoring scheme for the Galapagos ecosystem.

Distinguishing human impacts from natural changes

The stakes for sustaining a healthy biota are very high in Galapagos. Much of the Galapagos' economy is linked to its lucrative ecotourism industry. The connection between human welfare and biological health is powerful in Galapagos; perhaps nowhere else on Earth do so many people rely on their government to make good decisions about conserving biodiversity, both for the biota's sake and their own. An integrated and sensitive monitoring system can provide the information feedback loop required for distinguishing human impacts from natural changes, and thereby guiding development of effective management and policy. It can also provide the basis for the long-term forecasting that decision-makers find so useful. The challenge for Galapagos, where natural variability from year to year can be dramatic, is to develop a monitoring scheme that can identify the signal of human impacts among the often overwhelming and "normal" variability in the system associated with natural ecological cycles like El Niño.

Defining indicators through a collaborative process

Many more monitoring programs fail than succeed. And those that fail do so for many reasons. A common cause is that consensus was never reached among stakeholders on what needs to be measured (and paid for). We can't

monitor everything. And the indicators we select must be measured in a repeatable and standardized manner to be able to detect change and provide useful information to managers. We must collaboratively develop measures of what we think represent the essence of the system and the interactions among its most important drivers. This assumes we know enough about the ecosystem to measure its most salient aspects and drivers. Defining these indicators collaboratively so that there is general endorsement across stakeholders is essential to the ultimate success of any monitoring program.

Decision-makers need a comprehensive and "scalable" monitoring system

To be useful to decision-makers, monitoring must be comprehensive at the level of archipelago. It is relatively easy to develop a monitoring program focused on a specific component of any ecosystem, optimized to a specific type of organism or spatial scale. But busy decision-makers need information at many spatial scales, from specific sites to the entire archipelago, and for many different kinds of issues. A fragmented approach to monitoring ecosystem components in isolation from one another is destined to fail. Moreover, any monitoring system needs to always take into account the underlying values and mandates that define the ultimate purpose of the monitoring.

The importance of community engagement

Environmental monitoring is most successful when viewed as a community enterprise. More specifically, monitoring programs thrive when linked directly to a variety of local institutions. For example, the museum and botany collections, labs, and ecological, cultural, and sociological studies that are necessarily part of an integrated monitoring system can be made directly relevant and useful to schools, NGOs, citizen groups, and various branches of government. The outcome is general support of the monitoring enterprise because these linkages ensure that monitoring will be part of a larger public scientific inquiry. Establishing these linkages and having clear policies on public data dissemination should be thought through and stated early; monitoring programs without open access to the information generated and broad participation in their development usually fail.

Re-envisioning who does the monitoring

While monitoring has traditionally been done by academic scientists, there are several problems with this "experts only" model. First, there are too few experts to do the work. Secondly, they are too expensive to rely on. Thirdly, they often lack the traditional knowledge and local experience to function well in the field. Local people, on the other hand, who are surrounded by the biodiversity of Galapagos, have accumulated much more

knowledge than many academic researchers and are often heavily vested in learning about the environment upon which their livelihoods depend. This is not to say all local people have the time, skills, or inclination to participate, but many do. Identifying them and finding ways to engage them in respectful collaboration can solve many operational problems with monitoring programs. Citizen engagement likely has more potential to inform decision-making in Galapagos than anywhere in the world given the huge number of talented and concerned residents and visitors present in the Archipelago at any given time. Citizen engagement in ecosystem monitoring is also highly consistent with and supportive of national policies such as the Plan Nacional del Buen Vivir (SENPLADES, 2013), of which few other countries have any analog for the expectation of citizen involvement in the generation and interpretation of information for governmental decision-making.

New technology enhances monitoring and is cost effective

Return-on-investment is a perennial concern for monitoring programs. Monitoring is expensive and the data generated not always of obvious value. But technology for cost-effective monitoring is expanding at a tremendous speed. We can now communicate seamlessly and instantly around the world. An image someone in Galapagos takes of a cactus can be stored on a data server in China, measured by a person in Guayaquil, and the data analyzed by someone in Canada, with outputs that can assist decision-makers in Quito or Puerto Ayora. These new methodologies need to be leveraged.

How we gather monitoring data also needs to be re-envisioned. Monitoring is still equated with walking around with a notebook and binoculars, and writing down observations. But doing so is antiquated, expensive, and inefficient. There are stunning new ways of measuring the environment far more efficiently and comprehensively than were available even a decade ago. Sensor arrays, satellites, drones, and time-lapse cameras are examples. The challenge is deploying these new technologies intelligently and converting the ensuing information flood into timely and accessible knowledge.

This said, analysis of the state of the Galapagos environment without a continually refreshed sense of what things look like on the ground is going to fail. A strong connection of observation and data to direct field experience is essential to successfully interpret monitoring data no matter where it emanates from. This is to say that we must leverage the best from new information-rich technologies while continuing to ground truth the results, never losing the intuitive sense of how things work, which can only be gained from direct and frequent personal experience out in the Galapagos environment.

Monitoring costs much more than just data collection

New technology does not always generate a better approach for monitoring the environment. We are awash in information but starving for knowledge. The challenge is to sort through the best that new technologies offer and ignore the rest. We often give little thought to what to do with the data that pours out of monitoring schemes, whether generated by old-fashioned or modern methods. In fact, data management and communication is often an afterthought in the design of monitoring programs. Effectively analyzing the data collected and producing recommendations for management typically requires over half of the budget devoted to any successful monitoring program.

The importance of adaptability

Many have suggested that designing monitoring around a single question with fixed methods that do not change over time is the only way to proceed. But the reality is that methods change and so do the questions we want answers to. A successful system is one that adapts to new questions and new technologies in a timely fashion while serving the demands of the maximum number of stakeholders.

A good monitoring program not only looks backward at a baseline of historic conditions to measure change. It also enables one to look forward at a desired future state and measure where we are in relation to it. Having a clear approach for integrating data that addresses multiple and inevitably evolving questions, extending both backward and forward in time, greatly enhances the utility and longevity of any monitoring program.

Conclusions

The “dashboard” of an automobile, which displays a set of simple, informative, and timely indicators about the state of operation of a very complex machine, provides a good analogy for what we need for tracking the “vital signs” of Galapagos. An “ecosystem dashboard” for measuring what is happening in Galapagos would well serve many decision-makers charged with the responsibility for the fate of the natural ecosystem and the human population of Galapagos, which are ultimately and intimately tied together.

Could we develop a system to improve our understanding of and ability to forecast the impacts of climate change, land use change, visitor impacts, invasive species, and changing economies and human communities on biodiversity and ecosystem function? The program would need to focus on key questions and uncertainties facing Galapagos, be relevant both to specific sites and to the Archipelago as a whole, and rely on novel, cost-effective approaches including public participation. Virtually all

data would be open access to enable scientists, educators, planners, and decision-makers to map, understand, and predict primary effects of humans on the natural world and effectively address crucial questions and issues, not just for management but for science.

Is it possible to develop a reliable “ecosystem dashboard” for Galapagos? Do we have a sufficient shared sense of mission to conserve to develop one? Can we think critically and collaboratively about how Galapagos “works” to identify the key indicators we need to measure and monitor? What would it cost? Who and how would we pay for it? What would it deliver and by when?

There is great potential to develop an exemplary, integrated system for monitoring the Galapagos ecosystem. How we track the environment is changing dramatically and there is renewed interest around the world in the importance of monitoring for effective decision-making. Several decades of ecological monitoring have revealed what is problematic and what is useful for decision-making. Based on these experiences, perhaps it is time to proceed with re-envisioning what is required to build an integrated system for monitoring the Galapagos ecosystem and ensure it is an inclusive and relevant enterprise.

References

SENPLADES. 2013. Plan Nacional para el Buen Vivir 2013-2017. Quito. SENPLADES.